REMARKS/ARGUMENTS

Drawings

The drawings are objected to under 37 CFR 1.83(a). The Examiner requested that features cited in claims 35-38, in particular the perspective of a "current node", be clarified in the drawings.

The Examiner asserts that some limitations of claim 35 are focused on the perspective of "**current node**", but corresponding FIG. 5 is focused on the perspective of the **start optical node**". Applicant submits that step 508 of FIG. 5 identifies a neighboring node to a start node in the receive direction (upstream direction from the source node) and step 510 identifies a neighboring node to the start node in the transmit direction (downstream direction towards destination). Recursive steps 512 to 522 determine **current nodes**. Initially, step 508 or step 510 treats the start node as the current node and step 512 sends an enquiry message to a neighboring node represented by the variable "N". If step 520 determines that node "N" has no neighbor in the direction under consideration (receive direction or transmit direction) as determined in step 506, the process ends in step 524. Otherwise, if node "N" detected presence of a neighbor "M" in the direction under consideration, node "**N" becomes the current node** and node "M" becomes the neighboring node. Node "N" is now in charge and it knows that its neighbor is "M". Step 522 directs the process to step 512 which is implemented in **current node** "N" (instead of the start node) with a neighboring node "M". The term "current node" refers to "a node currently being visited" as defined in paragraph [0033] of publication 2004/0120710 of the present application (recited below):

> [0033] .... In traversing the light path, nodes are communicated in sequence and asked whether they have detected the wavekey specific to the light path being traced. The expected downstream (or upstream) node in the light path is discovered via provisioning information on **the node currently being visited**. Although it is typically executed from the head (source) node of the light path, the command for the Trace procedure can be executed **from any node along the light path**.

Applicant has reproduced the drawings and highlighted captions in FIG. 5 indicating correspondence to a current node (i.e., any node along a path from a source node to a destination node). Withdrawal of the objection to the drawings is therefore respectfully requested.

Claim Rejections – 35 U.S.C. § 112

Claims 35- 38 and 40 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Claims 39-40 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite.

Regarding claim 35, the Examiner asserts that the limitation of "*responsive to an indication that said start optical node is not said source optical node*" is not indicated in FIG. 5 and paragraphs [0033]-[0035].

Applicant gratefully acknowledges the thorough review of the claims and the Examiner's suggested improvement of the claims' language.

The limitations:
"responsive to an indication that said start optical node is not said source optical node";
"responsive to an indication that said start optical node is not said destination optical node";
"responsive to an indication that said start optical node is not said source optical node"; and
"responsive to an indication that said start optical node is not said destination optical node",

in claims 35-38, respectively, have been deleted.

Applicant amended claims 39 and 40 to include the qualifier "which detects said target optical signature" as suggested by the Examiner. Applicant further amended claim 40 to replace

the phrase "said each optical node" with the clearer phrase "said start optical node" as suggested by the Examiner.

Having complied with the Examiner's request, withdrawal of the rejections of claims 35-40 is respectfully requested.

Claim Rejections – 35 U.S.C. § 103

Claims 32-34 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carrick *et al.* (U.S. Patent 7,016,607 B1, hereinafter "Carrick") in view of Weik (Fiber Optics Standard Dictionary, 3rd edition), Rajagopalan *et al.* ("*IP over optical networks: architectural aspects*", hereinafter Rajagopalan"), and Stephens *et al.* (U.S. Patent 6,347,079 B1), hereinafter "Stephens").

The Carrick Reference

Carrick discloses a centralized configuration-management system which is the antithesis of the distributed configuration-management system of the present application. Carrick's system is based on communications of network nodes with a central controller 170 illustrated in FIG. 1 in Carrick. As stated in Carrick, the central controller (called "network Management Services") is connected to the network entities; please see column 4:10-12 "Connections between network management services 170 and the remainder of the optical network 100 are not shown so as not to obscure the example". Controller 170 comprises a processor 174 executing instructions stored in a memory 176. The processor 174 interacts with a database 172 for data retrieval and update. The nodes do not communicate with each other through message exchange.

The Weik Reference

On pages 242-243 of "*Fiber Optics Standard Dictionary*", Weik recited the conventional definition of a distributed database as follows *(emphasis added)*:

"**Distributed database**: A database that is stored at more than one location, in more than one device, or both. *Note*: Examples of a distributed database are databases that are (a)

dispersed among the nodes of a network, (b) placed in several storage units under the control of one or more data processors, and (c) **controlled by a single database management system**, but are contained in storage units that are not all connected to or under the control of the same processor."

Applicant notes that it is well known in the art that a distributed database is a collection of multiple, logically interrelated, database portions distributed over a computer network. However, a centralized database management system (DBMS) is **still required** to manage the database portions as if they were all stored on the same computer.

The Rajagopalan Reference

Rajagopalan describes path setup in a network using the well-known Constraint-based Label Distribution Protocol (CR-LDP).

The Stephens Reference

Stephens describes a network 100 (FIG. 1) comprising Network Elements (also called nodes) 20 and a single Network Management Element 30.

Please see column 6, lines 47-50:

> "The nodes 20 are controlled or managed by a network management element 30 which may control or manage any number, or group, of nodes 20."

Applicant notes that the system of the present application does not require a network management element.

The Present Application

The present application discloses a distributed configuration-management system in which nodes exchange messages **without communicating with any central facility**. The entire system is operated by independent operators of command line interfaces (CLIs) installed at the nodes. Please see paragraph [0007] and [0032] of publication 2005/0120710 of the present

application (emphasis added):

> [0007] The present invention relates to a Command Line Interface (CLI) based method and system (i.e., **not based on any centralized global knowledge**) for tracing the nodes traversed by an optical light path between a source node and a destination node in an OCN.
>
> [0032] The method for monitoring a light path of a signal in the optical network of the embodiment of the invention includes four procedures: Trace, Walk, Global Discovery and Local Discovery for identifying connectivity problems. These procedures **do not require any Network Management System (NMS) interaction**. Trace (Light path Trace), Walk, Global Discovery and Local Discovery can be invoked from a Command Line Interface (CLI). A brief description of each of these procedures is provided next.

Centralized system versus distributed system

Regarding claims 33 and 34, the Examiner suggests that it is obvious to convert the centralized system of Carrick to the distributed system of the present application.

As illustrated in FIG. 1 in Carrick, A central controller 170 (labeled "Network Management Services") comprises a processor 174, a memory 176, and a Network Database 172. The central controller 170 is connected to the network entities as stated in column 4:10-12: "Connections between network management services 170 and the remainder of the optical network 100 are not shown so as not to obscure the example."

To explore the feasibility of converting Carrick's system to the distributed system of the present application, the following structural and functional aspects need be taken into consideration.

(1) To access the network database 172 in Carrick, processor 174 retrieves program code from memory 176 and executes the program code for data retrieval or update. If the database 172 is stored in multiple locations, either in its entirety or partially, a processor 174 and a program storage memory 176

must also be installed at each of the locations.

(2) The Carrick system is based on communications between individual nodes and the central controller. The nodes in the Carrick network do not communicate with each other. Carrick does not mention or imply any facility allowing the nodes to exchange messages.

(3) A node in Carrick detects pilot tones and communicates information on the tones to the central controller 170.

(4) The central controller 170 oversees all the nodes in the network, stores information about all configured lightpaths in the network, receives pilot-tone information from the nodes, and determines integrity of any lightpath of interest by mapping received pilot-tone information onto stored lightpath configurations.

(5) If central controller 170 is replaced by a similar controller (though potentially having a reduced database) at each node in the network, then each node will have a dilemma regarding to which controller information on detected pilot tones should be sent. The objective of the entire system is to ascertain the integrity of lightpaths, hence sending the pilot-tone information from a node to the controller associated with the *same* node does not serve any purpose. A node may be traversed by numerous lightpaths and the node would need to communicate information on a specific detected pilot tone to controllers associated with nodes designated to receive the specific pilot tones. However, none of the nodes in Carrick has lightpath information. Thus, each node has to send information on its detected pilot tones to all controllers.

Clearly, direct conversion of the centralized system of Carrick to a distributed system can only produce chaos and even if chaos can be managed, the cost of database replication (even partially) is prohibitive given that each portion of the database must be accompanied by its driver, i.e., a processor 174 and program-storage memory 176.

Additionally, before exploring the feasibility of converting Carrick's centralized system into a distributed system, one has to find a reason for doing so. Carrick's centralized system is technically sound and very efficient for a medium-size network. The main objectives for resorting to the distributed system of the present invention include scalability to accommodate a network having a large number of nodes, reduced latency, and higher reliability. Direct replacement of the centralized database in Carrick with multiple databases dramatically increases cost, significantly reduces scalability, and increases latency.

The central controller 170 receives detected pilot tones from individual nodes and the processor 174 queries the database 172 to retrieve relevant data and compare with detected data, as stated in column 4:23-29: "Each node of the path is scanned to generate a list of its detected pilot tones in step 220. The network management database 172 is queried to generate a list of expected pilot tones for each node in step 230. The detected list is then compared with the expected list in step 240 to identify any mismatched nodes".

The Examiner suggests that an obvious variation would be to store the centralized Network Database 172 in multiple physical locations such as the nodes of network 100 of FIG. 1 in Carrick.

Applicant respectfully submits that the proposed variation, in addition to being prohibitively expensive, would only serve to frustrate Carrick's system. A node in network 100 in Carrick is trained to communicate detected pilot tones to the central controller 170. The central controller 170 collects similar data from other nodes and makes a decision regarding the integrity of a lightpath. If the database (or a portion thereof) is placed in more than one node, or as the Examiner suggested in each node, then to which database portion should a given node connect to direct information regarding detected pilot tones? Carrick discloses a technically sound system in which each node connects to one, and only one, controller 170.

Regarding cost, the proposed variation would require replicating the entire controller 170, including processor 174, memory 176, and a respective portion of network database 172, at each node, at a prohibitive expense; the network may include several thousand nodes. Processor 174 executes instructions relevant to data retrieval or update and is **not a substitute** of a processor, or

processors, embedded within each node in the network.

Even if cost is immaterial, placing the database (or a portion thereof) at each node does not serve any purpose. The objective of Carrick's system is to examine entire lightpaths each possibly traversing several nodes. Localized information at a node has still to be communicated to a central facility which can view other nodes traversed by a path.

Additionally, the Examiner mentions that a database may be geographically distributed among several repositories. Applicant notes that the purpose of distributing a database is to enable different communities of users to gain local access to at least a respective significant portion of the database. A distributed database is a collection of multiple, logically interrelated, database portions distributed over a computer network. However, a centralized database management system (DBMS) is still required to manage the database portions as if they were all stored on the same computer. Thus, even if network database 172 is to be distributed, a central DBMS is still needed.

In rejecting claim 33, the Examiner asserts that Carrick discloses a step of "storing at **network database 176**, for each lightpath planned to traverse said each optical node: an identifier of a respective optical signature; and identifiers of adjacent optical nodes designated to be along said each lightpath". Applicant notes that replacing the phrase "each optical node" with "network database 176" significantly alters the scope and intent of the claim.

The Examiner refers to column 4:33-39.

In column 4:19-39, Carrick describes steps **executed by processor 174** of central controller 170 according to which:

(1) Each node of the path is scanned to generate a list of **its detected pilot tones** in step 220;

(2) The **network management database** 172 is **queried** by processor 174 to generate a list of expected pilot tones for each node in step 230;

(3) The detected list is then compared by processor 174 with the expected list in step 240 to identify any mismatched nodes; and

(4) Once the discrepancies are identified at a particular node, pilot tones at adjacent nodes

of the network can be examined to localize the source of the network error.

Applicant submits that the system of the present application does not require a central controller 170 with a database 172. The **only entity** in the Carrick system that queries the database 172 is processor 174 of the central controller 170. Carrick does not mention or imply that a node queries the database 172 (or queries any other node). Please see the excerpts below, taken from the Carrick reference (emphasis added):

Column 4:6-8

> The **processor is capable of querying** or updating the database 172 in accordance with instructions stored in memory 176.

Column 11:53-59

> In one embodiment, this is accomplished through instructions that cause the **processor to perform a query** of the network database. The **processor is then instructed to identify mismatched nodes** when the expected and detected lists do not match. Similarly, program code stored in memory 176 can be used to instruct the processor to perform any or all of the methods set forth in FIGS. 1-10.

Thus, Carrick does not disclose the limitation:

"storing at each optical node, for each lightpath planned to traverse said each optical node:

> an identifier of a respective optical signature; and
>
> identifiers of adjacent optical nodes designated to be along said each lightpath."

For at least this reason, it is respectfully requested that the rejection of claim 33 be withdrawn.

The Examiner further asserts that Carrick discloses "selecting a target lightpath connecting a source optical node to a destination optical node and a **start optical node** along said target lightpath". The Examiner refers to the passage in column 4:23-25 which states "Each node of the path is scanned to generate a list of its detected pilot tones in step 220".

Applicant submits that purpose of scanning (step 220) is to determine pilot tones actually traversing a node. Step 210 in Carrick has already defined a lightpath and in step 220, the central

controller 170 is testing each node along the path. The limitation of "selecting a start optical node" is a feature of a distributed system and is inapplicable to the centralized system of Carrick where the central controller 170 has a full view of the entire network.

Regarding the limitation "storing **at each optical node**, for each lightpath planned to traverse said each optical node: an identifier of a respective optical signature; and identifiers of adjacent optical nodes designated to be along said each lightpath;" the Examiner asserts that obvious variations (presumably, of the Carrick system) would include storing the database of Carrick in multiple physical locations, such as the nodes of the network.

Applicant submits that the above limitation relates to storing very limited information at each node. The limited information stored in a node is only related to signatures (wavekeys) allocated to the node and identities of other nodes**. None of the nodes has any information about the itinerary of any lightpath**. In contrast, network database 172 in Carrick contains information about each lightpath.

A person skilled in the art is well aware that a distributed database is a collection of multiple, logically interrelated, database portions distributed over a computer network. However, a centralized database management system (DBMS) is still required to manage the database portions as if they were all stored on the same computer. The system of the present application does not require a centralized database management system. Instead, in the method of claim 33, each node communicates with its immediate neighbors and relies on simple tests at each node.

Regarding the limitation of "a target optical signature stored at said start optical node", the Examiner (page 10 of the office action) refers to obviousness of storing the Carrick database in each optical node.

The Examiner appears to equate storing a target optical signature at an optical node with storing Carrick's database in each optical node. Applicant notes that, as described above, storing information pertinent to a lightpath signatures expected at a node and identities of other nodes is not equivalent to storing a Carrick database. Carrick discloses a centralized controller communicating with individual nodes. The present application discloses a distributed system where nodes communicate with each other.

Regarding the limitation "at a command-line interface communicatively coupled to said start optical node", the Examiner asserts that Carrick's method is implemented using a processor, program code, and a computer, and a command-line interface is an obvious limitation for Carrick's method as a common way for a practitioner to interface with a processor, program code, and a computer.

Applicant submits that the method of Carrick is implemented by a central controller 170 and one may associate a command-line interface, or many command-line interfaces, with the central controller. In the system of the present application, there is no central controller, or equivalent. Numerous lightpaths may be configured and any node in the network may be a start node for tracing a respective lightpath. In fact, each node in the entire network may function as a start node for corresponding lightpaths. A command-line interface is therefore installed in each node which may function as a start node. Hence, there may be numerous command-line interfaces each coupled to one node not to a central controller such as central controller 170 in Carrick.

The Examiner further states "Since one could obviously interface with the method of Carrick through a command-line interface, common commands, such as running the method of Carrick, would be communicated to the various nodes including the start node. Such communication would mean that the command-line interface would be communicatively coupled to the various nodes, including the start optical node."

Applicant submits that the limitation regarding the command-line interface clearly describes a process of communicating a message comprising a target optical signature from **one node to adjacent nodes**. The Carrick reference does **not mention or imply any process where a node sends a message to any other node**. All communications in Carrick are between the central controller 170 and individual nodes.

Thus, Carrick does not disclose the limitation:

"at a command-line interface communicatively coupled to said start optical node:

> determining a target optical signature stored at said start optical node and associated with said target lightpath;
>
> progressively communicating a first message comprising said target optical signature to adjacent optical nodes to determine a first sequence of optical nodes designated to form said target lightpath."

For all the above reasons, it is respectfully requested that the rejection of claim 33 be withdrawn.

Claim 34 corresponds largely to claim 33 as the Examiner pointed out. Claim 34 describes a distributed configuration-management system while Carrick discloses a centralized configuration management system. As indicated in the discussion regarding claim 33, Carrick's centralized system cannot be converted to a distributed system. A combination of Carrick, Weik, Rajagopalan, and Stephens, even if feasible, does not produce the distributed system of the present application.

Accordingly, it is respectfully requested that the rejection of claim 34 be withdrawn.

Regarding claim 40, the Examiner asserts that Carrick in view of Weik, Rajagopalan, and Stephens discloses the steps of storing at each optical node a set of identifiers of all optical nodes and sending a message from a command-line interface communicatively coupled to the start optical node to each other optical node.

Applicant submits that an optical node in Carrick does not store identifiers of other optical nodes. Additionally, optical nodes in Carrick do not exchange messages among each other. Rather, each node communicates only with the central controller 170.

For at least these reasons, it is respectfully requested that the rejection of claim 40 be withdrawn.

Claims 31 and 32 depend on claim 33 which has been clearly distinguished from the prior art.

SUMMARY

The drawings have been reproduced to correct a typographical error and to highlight features specified in the claims.

Claims 31-40 are pending. Claims 35-38 have been amended according to the Examiner's suggestions to overcome rejections under 35 U.S.C. § 112.

No new material has been added by way of the above amendments.

In view of the foregoing, early favorable consideration of the application is earnestly solicited.

Respectfully submitted,

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